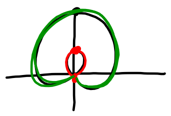
12.

$r = 1 + 2\sin\theta$ inner loop.



$\frac{1}{2}\int_{\theta_1}^{\theta_2} r^2\, d\theta$

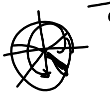
| $\theta$ | $r$ |
|---|---|
| $\frac{7\pi}{6}$ | 0 |
| $3\pi/2$ | -1 |
| $\frac{11\pi}{6}$ | 0 |

$0 = 1 + 2\sin\theta$

$-\frac{1}{2} = \sin\theta$

$\frac{1}{2}\int_{\frac{7\pi}{6}}^{\frac{11\pi}{6}} (1+2\sin\theta)^2\, d\theta$

$\theta = \frac{7\pi}{6}, \frac{11\pi}{6}, -\frac{\pi}{6}$



| $\theta$ | $r$ |
|---|---|
| $-\pi/6$ | 0 |
| $\pi/2$ | 3 |
| $\frac{7\pi}{6}$ | 0 |

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9. $\cancel{\text{I}}\ \sum_{n=1}^{\infty} \frac{2n}{n+3}$ II $\sum_{n=1}^{\infty} \frac{-8}{(-3)^n}$ III $\sum_{n=0}^{\infty} \frac{1}{2^n} = 1 + \frac{1}{2} + \frac{1}{4} \cdots$

$\frac{8}{3} - \frac{8}{9} + \frac{8}{27} \cdots = \frac{8/3}{1 - -\frac{1}{3}} = \frac{8/3}{4/3} = \frac{8}{4} = 2$

$\frac{1}{1 - 1/2} = \frac{1}{1/2} = 2$

geometric $\sum_{n=1}^{\infty} a r^{n-1}$ or $\sum_{n=0}^{\infty} a r^n$

converge to $\frac{a}{1-r}$

II & III

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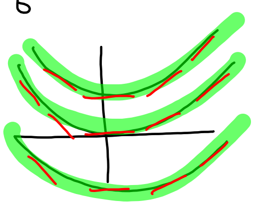
Review 12 Slopefields

Slopefields give us a graphical solution to a differential equation.

$\frac{dy}{dx} = \frac{x}{2}$

$y = \frac{x^2}{4} + c$



general solution (family of curves)

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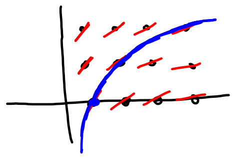
Ex 1.

$\frac{dy}{dx} = \frac{1}{x}$

draw the specific solution thru $(1,0)$



$y = \ln x + c$

$0 = \ln 1 + c$

$0 = 0 + c$

$0 = c$

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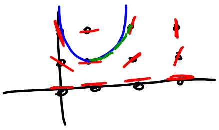
Ex 2 $y' = y^2(x-1)$ sketch the slopefield



draw specific solution thru $(1,1)$

$$\int \frac{dy}{y^2} = \int (x-1)\,dx$$

$$-\frac{1}{y} = \frac{x^2}{2} - x + C$$

$$-1 = \frac{1}{2} - 1 + C$$

$$-1 = -\frac{1}{2} + C \qquad C = -\frac{1}{2}$$

$$-\frac{1}{y} = \frac{x^2}{2} - x - \frac{1}{2}$$

$$y = \frac{-1}{\frac{x^2}{2} - x - \frac{1}{2}} \quad 2$$

$$y = \frac{-2}{x^2 - 2x - 1}$$

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